

Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

**0 439 146 A3**

(12)

## EUROPEAN PATENT APPLICATION

(21) Application number: 91100833.2

(51) Int. Cl.<sup>5</sup>: **G02F 1/135, B41J 2/445,  
G02B 26/10, B41J 2/525**

(22) Date of filing: 23.01.91

(30) Priority: 25.01.90 JP 15304/90  
25.01.90 JP 15305/90  
25.01.90 JP 15306/90  
25.01.90 JP 15307/90  
25.01.90 JP 15308/90  
25.01.90 JP 15309/90  
29.01.90 JP 18214/90  
29.01.90 JP 18216/90  
31.01.90 JP 20615/90  
08.02.90 JP 29225/90  
08.02.90 JP 29226/90  
19.10.90 JP 281532/90

(43) Date of publication of application:  
31.07.91 Bulletin 91/31

(84) Designated Contracting States:  
**DE FR GB NL**

(88) Date of deferred publication of the search report:  
28.10.92 Bulletin 92/44

(71) Applicant: **SEIKO EPSON CORPORATION**  
4-1, Nishishinjuku 2-chome  
Shinjuku-ku Tokyo-to(JP)

(72) Inventor: **Sonehara, Tomio, c/o Seiko Epson Corporation**  
3-5, Owa 3-chome  
Suwa-shi, Nagano-ken(JP)  
Inventor: **Kobayashi, Hidekazu, c/o Seiko Epson Corporation**  
3-5, Owa 3-chome  
Suwa-shi, Nagano-ken(JP)

(74) Representative: **Blumbach Weser Bergen  
Kramer Zwirner Hoffmann Patentanwälte**  
Radeckestrasse 43  
W-8000 München 60(DE)

(54) **Image forming device and two-dimensional optical scanning device.**

(57) Described are an image forming device and a two-dimensional optical scanning device. The image forming device comprises an electro-optic effect light valve (120) including a photoconductive material (102) and an electro-optic medium (101), means (106) for applying a recording electric field to said light valve, means (105) for inputting an image to said photoconductive material, and means for reading out an image from said light valve, and is characterized in that in said light valve (120) the electro-optic medium (101) undergoes a state-transition in response to a photoelectric conversion action of said photoconductive material (102). A preferred image input means is a two-dimensional optical scanning device, comprising a light beam generating means, a rotating polygon-mirror deflector for reflecting and

transmitting light beams output by said light beam generating means, a condensing optical means for focusing the light beams on a scanned plane to form an image, and a movable mirror linearly movable within a specified plane for reflecting the light beams deflected by said rotating polygon-mirror deflector into a direction at a given angle, wherein a scanning length  $l_p$ , the length of stroke  $l_s$  of said linear movable mirror, an angle  $(\alpha/2)$  formed between said movable mirror and the specified plane, and an angle  $\beta$  formed between said scanned plane and the specified plane satisfy the following two formulae:

$$l_p/\sin\alpha = l_s/\sin\beta$$
$$\alpha + 2\beta = \pi.$$

**EP 0 439 146 A3**

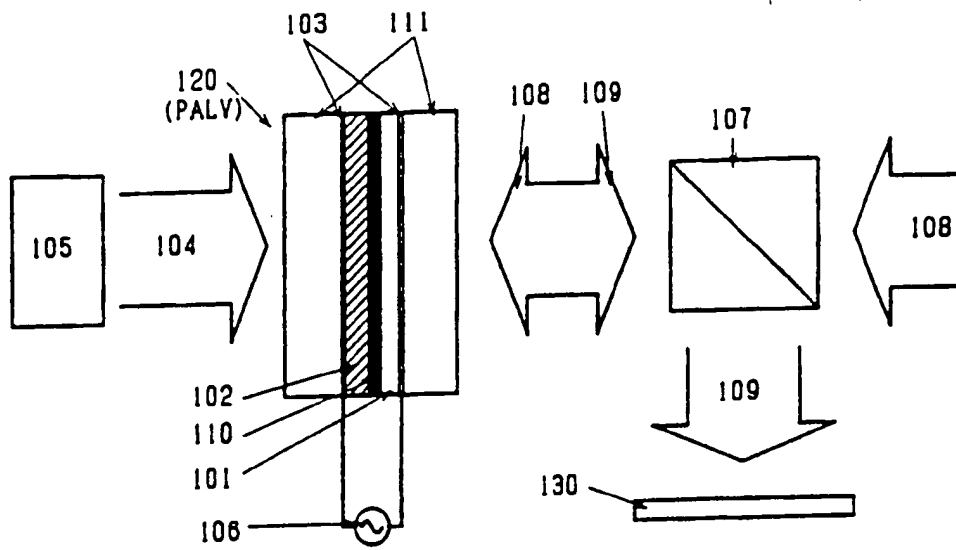


FIG. 1



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

EP 91 10 0833

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,D	PATENT ABSTRACTS OF JAPAN, vol. 9, no. 86 (P-349)[1809], 16th April 1985; & JP-A-59 216 126 (CANON K.K.) 06-12-1984 * Abstract *	1-8	G 02 F 1/135 B 41 J 2/445 G 02 B 26/10 B 41 J 2/525
Y,D	IDEM	11,15, 16,31- 34	
X	IEEE TRANSACTIONS ON ELECTRON DEVICES, vol. 36, no. 12, December 1989, pages 2959-2964, IEEE, New York, US; W. LI et al.: "Hydrogenated amorphous-silicon photosensor for optically addressed high-speed spatial light modulator" * Chapter II: "Device Description and Operation *	1-7,21- 23,25- 27	
Y	PATENT ABSTRACTS OF JAPAN, vol. 12, no. 354 (P-761)[3201], 22nd September 1988; & JP-A-63 108 323 (SEIKO EPSON CORP.) 13-05-1988	11,15, 16,31- 34	
X	US-A-4 733 307 (WATANABE) * Column 15, line 44 - column 18, line 63 *	35	
P,X	EP-A-0 385 346 (NIPPON TELEGRAPH & TELEPHONE) * Column 3, lines 29-46; column 8, lines 45-54; column 17, lines 14-24; column 19, line 34 - column 20, line 26 *	1-8,10, 21-27, 31-34	
--- -/-			
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27-07-1992	Examiner DIOT P.M.L.
<b>CATEGORY OF CITED DOCUMENTS</b>			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : technological background O : non-written disclosure P : intermediate document			

EPD FORM 1501 (11.82) (10/90/1)



### CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid.
- namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

### LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

See sheet -B-

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.
- namely claims: 1-6, 7-9, 35-36 (group 1 and 6)
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims.
- namely claims:



European Patent  
Office

## EUROPEAN SEARCH REPORT

Page 2

Application Number

EP 91 10 0833

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
A	PATENT ABSTRACTS OF JAPAN, vol. 12, no. 453 (P-792)[3300], 29th November 1988; & JP-A-63 175 828 (NEC CORP.) 20-07-1988 * Abstract * -----	31-34	
			TECHNICAL FIELDS SEARCHED (Int. CL.5)
<del>The present search report has been drawn up for all claims.</del>			
Place of search THE HAGUE		Date of completion of the search 27-07-1992	Examiner DIOT P.M.L.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

EPO FORM 1503 03/82 (P0401)



LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,

namely:

~~a posteriori~~

1. Claims 1-6,7-9 (as far as referring to claims 2-6) :  
An image forming device comprising an electro-optic effect characterized in that the electro-optic medium undergoes a state transition.

a posteriori

2. Claim 7 : Characterized in that said light valve comprises a read out blocking means.

a posteriori

3. Claims 8-10,31-34 : Characterized by output means/read-out.

a posteriori

4. Claims 11-20,29 : Characterized by image input means.

a posteriori

5. Claims 21-28,30 : Characterized by a driving signal of a recording field.

a priori

6. Claims 35-36 : A twodimensional optical scanning device.